

## **ENGINEERING ANALYSIS**

### **PROJECT DESCRIPTION**

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On December 14, 2022, the Department received a synthetic minor operating permit (SMOP) application from Circle K Scrap Metal, LLC for a 4,300 HP diesel engine (**Engine #3**) and requested to update the current 3,300 HP diesel engine (**Engine #1**) Permit (SMOP No. 403-0017-X002) to include reduced operational hours. **Engine #3** will be replacing the previously permitted 3,300 HP diesel engine associate with SMOP No. 403-0017-X003, which was heavily damaged shortly after startup and determined to be unsalvageable by the facility. These SMOPs will each be reissued and supersede the previously issued Permits.

On January 9, 2023, the Department received additional information for this application via email that confirmed the engine specifications and corrected an error on the initial submission (*i.e.*, corrected the type of catalyst used for both engines to an oxidation catalyst). Circle K also confirmed that the facility intends to maintain the current diesel oxidation catalyst (DOC) and continuous parameter monitoring system (CPMS) on **Engine #1**.

On January 10, 2023, the Department received additional information concerning **Engine #1**. Rather than opting for strict emergency-only operational limitations, Circle K has decided to continue maintaining **Engine #1** with the DOC, CPMS, and current **Subpart ZZZZ** requirements (*see discussion under FEDERAL REGULATIONS*).

### **PROCESS DESCRIPTION**

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The facility processes automobile and other mixed metallic scrap into ferrous scrap, nonferrous scrap, and nonmetallic “fluff” byproduct, which are sold as feedstock to other industries. Large pieces are fed into the shredder, which will be driven primarily by **Engine #3**. **Engine #1** will be used on an as-needed basis. Circle K has a MiraTech diesel oxidation catalyst (DOC) currently installed onto **Engine #1** to reduce CO emissions and will be required to install a similar DOC onto **Engine #3**.

*Table 1* shows the facility-wide potential emissions. Emissions from shredder and torch cutting operations for this facility were previously calculated in the engineering analysis dated January 6, 2022, which are reproduced in *Table 1*. SO<sub>2</sub> emissions are based on Circle K using ultra-low sulfur diesel fuel (*see discussion under FEDERAL REGULATIONS*), while emissions for **Engine #1** and **Engine #3** were calculated based on the maximum engine rating (*i.e.*, horsepower rating) and AP-42 factors for large stationary diesel engines (AP-42 Tables 3.4-1, -3, & -4). Calculations for uncontrolled engine emissions are included under Appendix A. CO emissions in *Table 1* conservatively factor the required 70% reduction.

**Table 1 – Facility-wide Potential Emissions**

Criteria Pollutant Emissions (TPY)	Pollutant	Shredder	Torch Cutting	Engine #1	Engine #3	TOTALS
	PM	4.23	0.076	0.58	2.26	7.15
	SO <sub>2</sub>	—	0.000	0.01	0.04	0.04
	NO <sub>x</sub>	—	0.017	18.48	72.24	90.74
	CO	—	0.009	6.70	26.19	32.90
	VOC	0.27	0.001	0.47	1.85	2.59
	Total HAPs	0.23	0.009	0.03	0.13	0.41
GHG Emissions (metric TPY)	CO <sub>2</sub>	—	15.497	955.39	3,734.69	4,705.58
	N <sub>2</sub> O	—	0.000	0.01	0.03	0.04
	CH <sub>4</sub>	—	0.001	0.04	0.15	0.19
	Mass Sum	—	15.498	955.43	3,734.87	4,705.80
	CO <sub>2</sub> e	—	15.561	958.62	3,747.32	4,721.50

## EMISSION LIMITS

As proposed in the permit application, **Engine #1** will be limited to no more than 500 total hours of operation during any consecutive 12-month period, while **Engine #3** will be limited to 1,400 hours. Each engine shall only operate with a non-resettable hour meter, CPMS for temperature and pressure, and DOC installed prior to startup. Circle K shall be required to meet the emission limitation under **Subpart ZZZZ** of either at least a 70% reduction in CO emissions or CO concentration no greater than 23 parts per million by volume dry (ppmvd) corrected to 15% O<sub>2</sub>.

Based on the current operational hour limit of 500 and 1,400 hr/yr for **Engine #1** and **#3**, respectively, the current NO<sub>x</sub> emission limit is no longer required for Circle K to remain below the major source threshold. However, the facility has expressed interest in increasing the operational hours limit for **Engine #3** in the near future following the initial performance test. If these hours should be increased, then NO<sub>x</sub> emission limits and testing requirement may be necessary for Circle K to remain beneath the 100 TPY threshold for major sources.

## STATE REGULATIONS

### ADEM Admin. Code r. 335-3-4-.01 – Visible Emission

**Rule 335-3-4-.01(1)(a)** states that no person shall discharge into the atmosphere from any source of emission, particulate of an opacity greater than that designated as twenty percent (20%) opacity, as determined by a six (6) minute average.

**Rule 335-3-4-.01(1)(b)** states that during one six (6) minute period in any sixty (60) minute period a person may discharge into the atmosphere from any source of emissions, particulate of an opacity not greater than that designated as forty percent (40%) opacity. Therefore, the permitted sources will be subject to this regulation. If visible emissions are observed, the opacity should be determined using Method 9 of Appendix A-4 to 40 CFR Part 60.

**ADEM Admin. Code r. 335-3-4-.04 – Process Industries - General**

**Rule 335-3-4-.04(1)** states that no person in a Class 1 County shall emit particulate matter greater than the amount determined by the equation below:

$$E = 3.59 \times P^{0.62}$$

where  $P$  = Process weight in tons per hour (ton/hr);  
 $P < 30$ ; and  
 $E$  = Emissions in pounds per hour (lb/hr).

**Rule 335-3-4-.04(3)** states “where the nature of any process or operation or the design of any equipment is such as to permit more than one interpretation of this rule, the interpretation that results in the minimum value for allowable emission shall apply.”

**Rule 335-3-4-.04(3)** states that all new sources subject to the PM emission rule “shall be subject to the rules and regulations for Class 1 Counties”, and therefore, this new source will be subject to the PM emission limit contained in **Rule 335-3-4-.04(1)**, regardless of location.

This hourly PM limit is dependent on the process weight over a given hour, interpolated from the above formula. Circle K is expected to remain well below this limit for the shredder.

**ADEM Admin. Code r. 335-3-14-.04 – Prevention of Significant Deterioration (“PSD”) Permitting**

Based on the emissions found in *Table 1*, the facility would not be expected to exceed the 250 ton/yr criteria pollutant threshold for major sources. Facilities must address PSD regulations for Greenhouse Gases (CO<sub>2</sub>, N<sub>2</sub>O, and CH<sub>4</sub>) only if that facility is major for criteria pollutants. Per **Rule 335-3-14-.04(2)(a)1.(i)&(ii)**, no PSD review would be necessary for this project.

**ADEM Admin. Code r. 335-3-14-.06 – Determinations for Major Sources in Accordance with Clean Air Act Section 112(g)**

This regulation applies to major sources of HAP emissions constructed after March 27, 1998. Since this facility is not a major source of HAP emissions, a 112(g) case-by-case MACT review would not be necessary.

**ADEM Admin. Code r. 335-3-15 – Synthetic Minor Operating Permits (“SMOPs”); & 335-3-16: Major Source Operating Permits (“MSOPs”)**

After considering the hourly operating limits for both engines and **Subpart ZZZZ** limits (discussed below), Circle K does not have the potential to emit greater than 100 ton/yr of any single criteria pollutant. Therefore, the facility will be considered a synthetic minor source for criteria pollutants.

To demonstrate compliance with the monthly and 12-month operational hour limitation, Circle K shall record the total operating hours of **Engine #3** each month using a non-resettable hour meter.....  
 .....**Rule 335-3-15-.04(1)(a)**

## FEDERAL REGULATIONS

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### 40 CFR Part 60, Subpart IIII — Standards of Performance for Stationary Compression Ignition Internal Combustion Engines

**Subpart IIII** is applicable to stationary compression ignition (i.e., diesel-fired) internal combustion engines manufactured after July 1, 2006. **Engine #3** was manufactured in 1996 and, therefore, is not subject to this subpart. .... **§ 60.4200(a)(2)**

### 40 CFR Part 63, Subpart A — General Provisions

**Engine #3** is subject to the provisions of **Subpart A** as prescribed under **§ 63.6665** and *Table 8 to Subpart ZZZZ*.

### 40 CFR Part 63, Subpart ZZZZ – National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines

#### Applicability

**Engine #3** is a 1996 model year stationary non-black start compression ignition (CI) reciprocal internal combustion engine (RICE) with a site rating greater than 500 HP located at an area source of HAP emissions whose construction occurred before June 12, 2006. Therefore, **Engine #3** is subject to the applicable emission limitations, operating limitations, and other requirements of **Subpart ZZZZ**. .... **§ 63.6595(a)(1)**

#### Emission Standards

In the submitted application, Circle K did not state that **Engine #3** was equipped with a closed crankcase ventilation system, as required for all existing non-emergency, non-black start CI engine greater than or equal to 300 HP according to **§ 63.6625(g)**. Circle K must install either a closed crankcase ventilation system that prevents crankcase emissions from being emitted to the atmosphere or an open crankcase filtration emission control system that reduces emissions from the crankcase by filtering the exhaust stream to remove oil mist, particulates and metals.

Circle K must comply with the requirements in *Table 2d to Subpart ZZZZ* and the operating limitations in *Table 2b to Subpart ZZZZ* (**§ 63.6603(a)**), which states that CO concentration in **Engine #3** exhaust shall be limited to either 23 parts per million by dry volume corrected to 15% oxygen content (23 ppmvd @ 15% O<sub>2</sub>) or reduce CO emissions by at least 70% (item 3 of *Table 2d to Subpart ZZZZ*). Circle K is proposing to comply with the requirement to limit or reduce the CO concentration in **Engine #3** exhaust by using a DOC; therefore, **Engine #3** must be equipped with a CPMS (items 1(a) & 2(a) of *Table 5 to Subpart ZZZZ*).

As provided in the permit application, Circle K will be required to use ultra-low sulfur diesel fuel (ULSD) for **Engine #3**, according to **§ 1090.305**.

The facility must also minimize the time spent at idle during startup and minimize the startup time to a period needed for appropriate and safe loading of the engine, not to exceed 30 minutes, after which time all applicable emission standards will apply (**§ 63.6625(h)**).

### Emissions Monitoring

Circle K has not proposed an alternative maintenance plan for **Engine #3** and, therefore, shall operate and maintain **Engine #3** and DOC according to the manufacturer's emission-related written instructions in accordance with **§ 63.6625(e)**.

According to **§ 63.6625(b)**, Circle K must install, operate, and maintain each CPMS according to the requirements in **§ 63.6625(b)(1)** through **(6)**. These include the following requirements:

- Prepare a site-specific monitoring plan (SSMP) that addresses the CPMS design, data collection, and the quality assurance and quality control elements outlined in **§§ 63.6625(b)(1)(i)** through **(v)** and **63.8(d)**.....**§ 63.6625(b)(1)**
- The performance criteria and design specifications for the monitoring system equipment, including the sample interface, detector signal analyzer, and data acquisition and calculations. ....**§ 63.6625(b)(1)(i)**
- Sampling interface (e.g., thermocouple) location such that the monitoring system will provide representative measurements..... **§ 63.6625(b)(1)(ii)**
- Equipment and procedures for performance evaluations, system accuracy audits, or other audit procedures..... **§ 63.6625(b)(1)(iii)**
- Ongoing operation and maintenance procedures in accordance with provisions in **§§ 63.8(c)(1)(ii)** and **(c)(3)**. .... **§ 63.6625(b)(1)(vi)**
- Note: **§ 63.8(c)(3)** references **§ 63.7**; however, *Table 8 to Subpart ZZZZ* specifically excludes *Conditions for conducting performance tests* paragraphs under **§ 63.7(e)(1)** from applying to **Subpart ZZZZ**. Therefore, **§ 63.7** shall apply, except for **§ 63.7(e)(1)**.
- Ongoing reporting and recordkeeping procedures in accordance with provisions in **§§ 63.10(c)**, **(e)(1)**, and **(e)(2)(i)**. .... **§ 63.6625(b)(1)(v)**
- Note: **§ 63.10(e)(1)** only applies to facilities who have a CEMS (continuous emissions monitoring systems) does not apply to Circle K
- Install, operate, and maintain each CPMS in continuous operation according to the procedures in your site-specific monitoring plan.....**§ 63.6625(b)(2)**
- The CPMS must collect data at least once every 15 minutes.....**§ 63.6625(b)(3)**
- The temperature sensor must have a minimum tolerance of 2.8 degrees Celsius (5 degrees Fahrenheit) or 1 percent of the measurement range, whichever is larger.....**§ 63.6625(b)(4)**
- Conduct the CPMS equipment performance evaluation, system accuracy audits, or other audit procedures specified in your site-specific monitoring plan at least annually.....**§ 63.6625(b)(5)**
- Conduct a performance evaluation of each CPMS in accordance with your site-specific monitoring plan .....**§ 63.6625(b)(6)**

Except during periods of startup, Circle K must maintain the pressure drop across the DOC to within 2 inches of water column from the pressure drop measured during the initial performance test. ....  
.....Item 2(a) of *Table 2b to Subpart ZZZZ*

A CPMS will be also used to monitor the DOC inlet temperature ( $T_{inlet}$ ). Except during periods of startup, Circle K must maintain the  $T_{inlet}$  between 450 °F and 1,350 °F ( $450^{\circ}F \leq T_{inlet} \leq 1350^{\circ}F$ ).....  
..... Item 2(b) of *Table 2b to Subpart ZZZZ*

All monitoring data will be gathered and collected according to **§ 63.6635**.....**§ 63.6625(b)(3)**

Pursuant to **§ 63.6640(a)**, Circle K will demonstrate continuous compliance with CO emission limit (i.e., 70% reduction or concentration of 23 ppmvd @ 15% O<sub>2</sub>) in *Table 2d* by adhering to the following requirements from item 10(a) of *Table 6 to Subpart ZZZZ*:

- Conducting a performance test once every 3 years for CO to demonstrate that the 70% CO reduction is achieved or that CO concentration remains at or below the 23 ppmvd @ 15% O<sub>2</sub> limit.....Item 10(a)(i)
- Collecting the catalyst inlet temperature data according to **§ 63.6625(b)**.....Item 10(a)(ii)
- Reducing these data to 4-hour rolling averages.....Item 10(a)(iii)
- Maintaining the 4-hour rolling averages within the operating limitations for the catalyst inlet temperature.....Item 10(a)(vi)
- Measuring the pressure drop across the catalyst once per month and demonstrating that the pressure drop across the catalyst is within the operating limitation established during the performance test. ....Item 10(a)(v)

#### Compliance and Performance Testing Methods & Procedures

According to **§ 63.6630(a)** through **(b)**, the facility will demonstrate initial compliance with each applicable emission limitation, operating limitation, and other requirement according to the following criteria from item 1(a) of *Table 5 to Subpart ZZZZ*:

- Reduced CO emissions determined from the initial performance test achieves the required 70% reduction (or met the CO concentration limit of 23 ppmvd @ 15% O<sub>2</sub>).....Item 1(a)(i)
- Installed a CPMS to continuously monitor DOC inlet temperature according to the requirements in **§ 63.6625(b)** ..... Item 1(a)(ii)
- Recorded the pressure drop across the DOC and DOC inlet temperature during the initial performance test..... Item 1(a)(iii)

Circle K must conduct all performance tests according to the requirements from item 1 of *Table 4 to Subpart ZZZZ*, while subsequent performance tests shall be conducted according to the intervals specified in item 4 of *Table 3 to Subpart ZZZZ*. Since Circle K is limited to operating Engine #3 no more than 1,400 hr/yr, subsequent performance tests will be conducted once every 3 years. During each performance test, the facility shall use Method 10 of Appendix A-4 to Part 60 to determine CO emissions.

#### Recordkeeping & Reporting Requirements

Since **Engine #3** does not meet the definition of a “limited used stationary RICE” under **Subpart ZZZZ (§ 63.6675)**, Circle K must submit a semiannual compliance report (SCR) according to the requirements of **§ 63.6650(b)(1)** through **(5)**..... Item 1(a)(i) of *Table 7 to Subpart ZZZZ*

- The first SCR must cover the period beginning on the initial startup date of **Engine #3** and ending on June 30 or December 31, whichever is first.....**§ 63.6650(b)(1)**
- Each subsequent SCR must cover the semiannual reporting period from January 1 through June 30 or July 1 through December 31.....**§ 63.6650(b)(3)**
- All SCR must be postmarked or delivered no later than July 31 or January 31, whichever is first date following the end of the reporting period. ....**§§ 63.6650(b)(2) & (4)**



- If there were no malfunctions, deviations from any applicable emission or operating limitations, and no periods during which the CPMS was out-of-control, Circle K must include a statement that says: "During the reporting period, there were no malfunctions, no deviations from applicable emission or operating limitations, and no periods during which the CPMS was out-of-control."Item 1(a) of *Table 7 to Subpart ZZZZ*
- Since the facility is limiting the hours of operation for **Engine #3** to no more than 1,400 hr/yr to remain a synthetic minor operator, Circle K must also include the monthly and 12-month rolling total of operational hours for **Engine #3** for each month in the reporting period.....**Rule 335-3-15-.04(1)(a)**

However, if Circle K experienced a malfunction during the reporting period, the SCR must also include the following information in **§ 63.6650(c)(4)**: .....Item 1(c) of *Table 7 to Subpart ZZZZ*

- The number, duration, and a brief description for each type of malfunction which occurred during the reporting period and caused (or may have caused) any applicable emission limitation to be exceeded; and
- A description of actions taken by Circle K during a malfunction of **Engine #3** to minimize emissions in a manner consistent with safety and good air pollution control practices for minimizing emissions, including any actions taken to correct a malfunction

If the CPMS was out-of-control during the reporting period, the SCR must also include the following information in **§ 63.6650(e)**: .....Item 1(b) of *Table 7 to Subpart ZZZZ*

- The date and time that each malfunction started and stopped;
- The date, time, and duration that each CPMS was inoperative, except for zero (low-level) and high-level checks;
- The date, time, and duration that each CPMS was out-of-control, including start and end dates and hours and descriptions of corrective actions taken;
- The date and time that each deviation started and stopped, and whether each deviation occurred during a period of malfunction or during another period;
- A summary of the total duration of the deviation during the reporting period, and the total duration as a percent of the total source operating time during that reporting period;
- A breakdown of the total duration of the deviations during the reporting period into those that are due to control equipment problems, process problems, other known causes, and other unknown causes;
- A summary of the total duration of CPMS downtime during the reporting period, and the total duration of CPMS downtime as a rolling percent of the total operating time of **Engine #3** at which each CPMS downtime occurred during that reporting period;
- An identification of each parameter and pollutant (i.e., CO) that was monitored at **Engine #3**;
- A brief description of **Engine #3** and the CPMS;
- The date of the latest CPMS certification/audit; and
- A description of any changes in CPMS, processes, or controls since the last reporting period.

To demonstrate compliance with applicable emissions and operating limitations, Circle K shall maintain all of the following records described in **§§ 63.6655(a)(1)** through **(a)(5)** and **(b)(1)** through **(b)(3)**:

- A copy of each notification and report submitted to the Department and/or EPA. ....**§ 63.6655(a)(1)**

- Records of the occurrence and duration of each malfunction of process equipment, **Shredder, Engine #3**, the DOC, or CPMS. .... §§ 63.6655(a)(2) and 63.10(b)(2)(viii)
- Records of performance tests and performance evaluations, including all results of performance tests, CPMS performance evaluations, and opacity and visible emission observations..... §§ 63.6655(a)(3) and 63.10(b)(2)(vii)
- Records of all required maintenance performed on the DOC and CPMS. ....§ 63.6655(a)(4)
- Records of actions taken during periods of malfunction to minimize emissions in accordance with good air pollution control practices, including corrective actions to restore malfunctioning process and air pollution control and monitoring equipment to its normal or usual manner of operation. .... §§ 63.6655(a)(5) and 63.6605(b)
- Each period during which the CPMS was malfunctioning or inoperative; all required data needed to demonstrate compliance with **Subpart ZZZZ**; all measurements as may be necessary to determine the conditions of performance tests and performance evaluations; all CPMS calibration checks; all adjustments and maintenance performed on CMS ..... §§ 63.6655(b)(1) and 63.10(b)(2)(vi), (vii), and (ix) through (xi), respectively
- Previous (i.e., superseded) versions of the performance evaluation plan for at least 5 years following the implementation of each new revision ..... §§ 63.6655(b)(2) and 63.8(d)(3)

Based on results from the previous performance test of **Engine #1**, § 63.6655(b)(3) (i.e., requests for alternatives to the relative accuracy test for CPMS) is not expected to apply to Circle K.

**RECOMMENDATIONS**

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This analysis indicates that the proposed emission sources would meet the requirements of all federal and state rules and regulations. Based on the expected emissions from the facility, I recommend that Circle K Scrap Metal, LLC be issued SMOP Nos. 403-0017-X002 & -X004 for **Engine #1** and **Engine #3**, respectively. These new Permits will supersede the previously issued SMOP Nos. -X002 & -X003, all copies of which should be returned to the Department.

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